Christmas tree allergy: mould and pollen studies

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Summary: A history of respiratory or other allergic symptoms during the Christmas season is occasionally obtained from allergic patients and can be related to exposure to conifers at home or in school. Incidence and mechanism of production of these symptoms were studied. Of 1657 allergic patients, respiratory and skin allergies to conifers occurred in 7%. This seasonal syndrome includes sneezing, wheezing and transitory skin rashes. The majority of patients develop their disease within 24 hours, but 15% experience symptoms after several days' delay. Mould and pollen studies were carried out in 10 test sites before, during and after tree placement in the home. Scrapings from pine and spruce bark yielded large numbers of Penicillium, Epicoccum and Alternaria, but these failed to become airborne. No significant alteration was discovered in the airborne fungi in houses when trees were present. Pollen studies showed release into air of weed, grass and tree pollens while Christmas trees were in the house. Oleoresins of the tree balsam are thought to be the most likely cause of the symptoms designated as Christmas tree allergy.

Allergists occasionally elicit a history of a flare-up of respiratory or other symptoms during the Christmas season, which often appears to be related to exposure to conifers at home or in school. While the symptoms evoked are usually not severe enough to require medical attention, the mechanisms by which they could be produced, as well as their frequency, were thought worthy of study. Discussion with colleagues suggested that symptoms might result from inhalation of the balsam oleoresin, or from sensitivity to moulds, pollens, or dust from tree decorations.

A review of the literature revealed only one paper related to the subject. In 1929 Cobe[1] described three asthmatic patients whose disease worsened before Christmas when trees and ornaments were placed in the ward. He concluded that the decorations as well as the tree itself were a potential atopen. While it has been stated that pollens of conifers have little or no clinical significance,[2] a few documented cases of asthma due to pine pollen have been reported.[3] In a Swedish study,[4] routine patch testing with balsam of pine and spruce demonstrated a positive response in over 5% of patients.

The authors have attempted to determine some of the possible causes of Christmas tree allergy, both by clinical means and by direct observation of particles brought in on the tree.

Clinical study

A retrospective review was made of 1561 patient records to ascertain the frequency with which patients with respiratory allergy volunteer a history of a seasonal exacerbation of their symptoms at Christmastime. Only 26 (1.66%) gave such a history when not specifically questioned on this point. We then carried out a prospective study in which all new patients with respiratory allergy and urticaria were asked whether there was a seasonal flare-up, the symptoms they experienced, its time of onset in relation to the introduction of the tree into the house, and its duration. From June 1968 to June 1969, 1657 patients were questioned. Ninety-one were eliminated from the study since, mainly for religious reasons, their exposure to the Christmas tree was negligible or nil. The type of tree used at the previous Christmas is tabulated in Table I. Ninety-four patients admitted to allergic symptoms in relation to the tree, an incidence of 5.6% (Table II). If the 61 patients who had no such exposure are excluded, the frequency rises to 6%, and if those

TABLE I
Type of tree used by 1355 patients at the previous Christmas

	No. of patients	%
Scotch pine	660	48.7
Artificial	341	25.1
Spruce	250	18.4
Fir	12	.9
Austrian pine	1	
No tree	91	6.7

Presented at the Annual Meeting of the Canadian Society of Allergy and Clinical Immunology, Montreal, June 20, 1969.
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TABLE II
Incidence of Christmas tree allergy

Prospective study (1968-1969) of 1657 allergic patients:	
Admitted history of Christmas tree allergy	94 (5.6%)
If 91 who had no tree exposure are excluded	1566 (6.0%)
If 341 who had an artificial tree are excluded	1225 (7.6%)

who had artificial trees are also eliminated, the incidence rises to 7.6%. The latter figure is somewhat high, because a number of patients who have had problems with conifers in the past will naturally tend to use artificial trees henceforth. Therefore, the true incidence of Christmas tree allergy in the allergic populace is about 7%, a much higher figure than one would have suspected.

We then studied some of the clinical features of this seasonal exacerbation in 100 patients, made up of the 94 from the prospective study plus six from the retrospective study who were recalled for further questioning. The age and sex distribution, as well as the type of tree involved, are listed in Table III. Chronic allergic rhinitis was the commonest type of allergic disease giving rise to the presenting complaints. Many of these patients presented with combinations of seasonal and perennial symptoms and of rhinitis and asthma in patterns similar to those seen in all patients with allergic respiratory disease. Of interest is the absence of patients whose presenting complaint was urticaria or angioedema. This could be significant or could simply be due to the relative infrequency with which this type of patient is seen in practice, namely around 10%. The three patients who had no presenting disease but who had problems only at Christmastime were relatives of patients under investigation. Two of these had transient skin rashes from contact with the tree and one had urticaria; none experienced respiratory symptoms.

TABLE III
100 patients with Christmas tree allergy

Age distribution	4-77 years
Mean average age	26.4 years
Females	67%
Males	33%
Type of tree involved:	
Scotch pine	67
Spruce	19
Both	4
Cedar	1
Fir	1
Austrian pine	1
Unknown	5
Major presenting disease:	
Asthma:	
Seasonal	24%
Perennial	44%
Rhinitis (all types):	
Seasonal	52%
Perennial	64%
None	3%

TABLE IV
100 patients with Christmas tree allergy

Symptoms evoked by tree:	%
Nose:	
Watering	18
Itching	6
Sneezing	31
Blockage	26
Eyes:	
Watering	13
Itching	17
Swelling	9
Redness	6
Chest:	
Cough	22
Wheeze	29
Tightness	24
Skin:	
Transitory rash	28
Vesicles and exudate	1
Angioedema	3
Urticaria	2
(Rash the only symptom in 18%)	
Onset pattern:	
Early onset	71
Late onset	15
Unknown	14
Course of symptoms:	
Constant	15
Improve as tree dries	11
Worsen as tree dries	9
Indefinite	65
Positive skin tests (scratch):	
Dust	78
Grasses	68
Ragweed	60
Moulds	57
Trees	45

Symptoms initiated by the tree are tabulated in Table IV. Sneezing is the most frequent response, then wheezing, transitory rash and blocking of the nose. Most patients had more than one of these complaints. The pattern of symptomatology generally followed that experienced with the major presenting disease. For example, all but one of the patients who developed asthma from contact with the tree had asthma as their presenting disease. The transitory rash seems to be an entity unto itself, as one might expect, since it probably represents a contact allergy to the oleoresin of the balsam. Twenty-eight patients suffered from an eruption consisting of multiple small, red, itchy or burning spots on the forearms and hands and occasionally on the face, where the skin had contacted the needles; this started within five minutes of trimming or decorating the tree and usually disappeared within half an hour. Urticarial and angioedematous reactions, however, occurred from indirect contact with the tree. Of the 28 patients with a transitory eruption, 18 (65%) experienced this as their only symptom.

The time of onset of symptoms in relation to the introduction of the tree into the household is important, since it suggests the etiology of the disorder. The majority (71%) noted respiratory or skin symptoms either while decorating or trimming the tree or within 24 hours, and one would surmise that these patients are sensitive to the balsam, either by contact or by inhalation. However, 15% noted an onset usually three to four days after the tree was set up, and some of these symptoms were worse rather than improved as the tree dried out, suggesting a factor other than balsam sensitivity. Unfortunately, accurate data as to the course of the symptoms in relation to the time the tree was in the house were not available in 65% of cases.

From an attempt to correlate the scratch test results with the syndrome, the only fact which emerges is that these patients generally tend to have multiple allergies.

Particle analysis

In investigating the occurrence of allergenic particles on Christmas trees, two possibilities were pursued, mould spores and pollen grains. It seemed possible that as the tree dried out in the home these particles would be released and could thus be detected in the air.

During the Christmas season of 1968-69, 10 dwellings of various kinds in the Kitchener-Waterloo area were studied. After a control study period of five days, seven Scotch pine and three spruce trees

were placed in the living rooms of these dwellings for 14 days. A further control period of four days followed removal of the trees. Three Petri plates containing Martin's Rose Bengal agar were exposed daily for three hours at each test site. The plates were set at points both near and distant from the tree, but all were in the room where the tree was located. After a suitable incubation period the resulting mould colonies were counted and identified as to genus and species.

At the time of installation of the tree, bark scrapings were taken and plated out on Martin's Rose Bengal agar.

The pollen grains were studied by direct microscopic examination. Three microscope slides coated with petroleum jelly were exposed in each room for three days before the tree was placed in the house and then changed every three days afterwards. Using Calberla's stain and two cover slips, each slide was traversed five times using the low-power objective and identification made with the high dry objective.

TABLE VI
House D—Number of mould colonies
Fifth floor of new apartment: hot-water heating

December			
15	4 Penicillium		
16			
17			
18	9 Cladosporium	3 Alternaria	
19			
	Scotch Pine		
20	4 Cladosporium	3 Alternaria	
21	62 Penicillium		
22	3 Penicillium		
23	8 Penicillium		
24	5 Cladosporium	4 Alternaria	
25	4 Cladosporium		
26	6 Alternaria	5 Penicillium	5 Cladosporium
27			
28			
29	4 Cladosporium	3 Epicoccum	
30	5 Penicillium		
31	5 Penicillium	5 Alternaria	
January			
1	12 Cladosporium	3 Epicoccum	3 Fusarium
2	4 Penicillium	3 Epicoccum	3 Alternaria
3	Tree removed		
4	5 Aspergillus		
5	4 Cladosporium		
6			

Bark scrapings: 50% Penicillium sp.
25% Epicoccum
25% Alternaria

Results

The moulds isolated from the tree scrapings appeared to be fairly characteristic (Table V). The majority of pines showed a heavy growth of *Penicillium spinulosum*, with *Epicoccum nigrum* and *Alternaria tenuis* providing most of the remainder. Spruce trees, on the other hand, showed no growth of Penicillium, even though they were from the same farms as some of the pines. Instead, Epicoccum and Alternaria were the major moulds isolated, as well as a small number of Cladosporium sp. from one tree.

The airborne mould studies proved more difficult to evaluate.

TABLE V
Percentage of fungi cultured from Christmas tree bark scrapings

Scotch pine:								
House	*A*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Source	*Acton*	*Orange-ville*	*Kit-chener-Waterloo*	*Colling-wood*	*Pene-tang*	*Pene-tang*	*Colling-wood*	*Kit-chener-Waterloo*
	%	%	%	%	%	%	%	%
Penicillium spinulosum	50	50	—	70	70	—	50	90
Epicoccum	50	25	40	10	10	40	30	5
Alternaria		25	50	10	10	40	10	—
Cladosporium			10	10	10	10	10	—
Other Penicillia						10		5

Spruce			
House	*B*	*C*	*E*
Source	*Acton*	*Pene-tang*	*Kit-chener-Waterloo*
	%	%	%
Epicoccum	50	50	40
Alternaria	50	50	50
Cladosporium			10

TABLE VII
Average number of mould colonies per day (three plates per house)

Moulds	*Pre-tree*	*Tree*	*Post-tree*
Penicillium	52	112	74
Cladosporium	38	60	105
Aspergillus	15	27	19
Alternaria	8	7	1.5
Epicoccum	3	5	—
Mucor	3	4	3
Chrysosporium	—	1	10
Scopulariopsis	—	2	—
Sistotrema	2	1	2.5

The air spora seemed to vary from house to house, indicating that each house has its own characteristic fungus flora. Results from one of the test sites are shown in Table VI. This individuality is probably due to many factors, including degree of cleanliness, age of the house, number of occupants, presence of pets, method of storing foodstuffs, type of heating, ventilation characteristics, etc.

TABLE VIII
Pollen studies (three slides per house)

	House date	Ragweed	Sage	Grass	Plantain	Pine	Spruce	Poplar	Juniper	Unidentified	Mould spore	Alternaria
	Control	—	—	—	—	—	—	—	—	—	—	—
	Dec. 20	—	4	1	—	2	—	1	—	—	—	—
A	Dec. 23	1	1	1	—	1	—	—	—	—	—	—
	Dec. 27	—	—	—	—	—	—	—	—	4	—	—
	Dec. 30	11	3	1	—	—	—	—	3	—	20	—
	Control	—	—	—	—	—	—	—	—	—	—	—
	Dec. 20	1	2	1	—	—	1	—	—	—	—	1
B	Dec. 23	—	—	—	—	—	—	—	—	1	—	—
	Dec. 27	2	—	—	—	—	2	—	—	—	—	—
	Dec. 30	12	4	3	2	—	—	—	1	—	45	—
	Control	3	—	—	—	—	—	—	—	—	—	—
	Dec. 20	—	7	3	—	—	1	—	—	—	—	—
C	Dec. 23	1	—	—	—	—	—	—	—	—	—	—
	Dec. 27	2	—	—	—	—	—	—	—	—	—	—
	Dec. 30	6	—	—	—	—	1	—	—	—	45	1
	Control	—	—	1	—	—	—	—	—	—	—	—
	Dec. 20	6	3	3	—	2	—	1	—	—	—	—
D	Dec. 23	—	—	—	—	1	—	—	—	1	—	—
	Dec. 27	2	—	—	—	1	—	—	—	1	—	—
	Dec. 30	1	1	—	—	1	—	—	—	—	275	—
	Control						Omitted					
	Dec. 20	—	—	—	—	—	1	—	—	—	—	—
E	Dec. 23	1	—	—	—	—	2	—	—	2	—	—
	Dec. 27	3	—	—	—	—	—	—	—	3	—	—
	Dec. 30	4	—	—	—	—	1	—	—	—	26	—
	Control	—	—	2	—	—	—	—	—	—	—	—
	Dec. 20	2	—	—	—	—	—	—	—	—	—	—
F	Dec. 23	—	2	—	1	24	—	—	—	2	—	—
	Dec. 27	—	—	—	—	—	—	—	—	—	—	—
	Dec. 30	1	3	—	—	1	—	—	—	—	—	1
	Control	—	—	1	—	—	—	—	—	—	—	—
	Dec. 20	2	—	—	—	1	—	—	—	—	—	—
G	Dec. 23	—	—	—	—	—	—	—	—	—	—	—
	Dec. 27	1	—	—	—	—	—	—	—	1	—	—
	Dec. 30	1	2	—	1	—	—	—	—	—	—	—
	Control	—	—	—	—	—	—	—	—	—	—	—
	Dec. 20	1	—	1	—	—	—	—	—	2	35	1
H	Dec. 23	—	—	4	—	—	—	—	—	—	—	—
	Dec. 27	—	—	2	—	—	—	—	—	3	—	—
	Dec. 30	2	2	1	—	—	—	—	—	—	20	—
	Control	—	—	—	—	—	—	—	—	—	—	—
	Dec. 20	—	—	—	—	6	—	—	—	1	—	1
I	Dec. 23	—	1	—	4	3	—	—	—	5	—	—
	Dec. 27	—	—	—	—	—	—	—	—	1	—	—
	Dec. 30	12	7	5	1	2	—	3	2	—	40	—
	Control	—	—	—	—	—	—	—	—	—	—	—
	Dec. 20	1	—	—	—	—	—	—	—	—	—	—
J	Dec. 23	—	—	—	—	—	—	—	—	—	—	—
	Dec. 27	2	—	—	—	—	—	—	—	2	—	—
	Dec. 30	—	—	—	—	—	—	—	—	—	—	—

At first glance the introduction of the Christmas tree into the house would seem to have had a fairly dramatic effect upon the number of spores in the air (Table VII). Nearly twice as many colonies per day were recorded after the tree arrived. The number of colonies recorded after the tree was removed, however, did not revert to the original number but remained nearly the same. Perhaps the newly introduced spores remained in the houses for some time after the trees were removed. A second possibility is that the rise in the number of spores was not directly related to the introduction of the tree. The moulds most common on the tree scrapings were not usually the commonest on the plates, indicating that the spores trapped in the plates came from a different source. While one of the commonest moulds on the pine-tree scrapings was *Penicillium spinulosum*, the most abundant airborne fungi were *P. digitatum, P. roqueforti* and *P. cyclopium. P. digitatum* is the cause of the common mould of citrus fruits which is so well known to housewives, while *P. roqueforti* is most commonly found on cheese of the Roquefort type.

The mould studies, then, are mainly inconclusive. It is quite possible that the resident population of fungus spores in the house masks the few extra spores that come in with the tree. Such a study would probably be best carried out in rooms that remain nearly sterile throughout the study except for the tree. The most interesting result of this investigation was the demon-

TABLE IX
Total pollen counts for all houses

All houses date	*Ragweed*	*Sage*	*Grass*	*Plantain*	*Pine*	*Spruce*	*Poplar*	*Juniper*	*Unidentified*	*Mould spore*	*Alternaria*
Control	3	—	4	—	—	—	—	—	—	—	—
Dec. 20	12	16	9	—	11	3	1	1	3	35	3
Dec. 23	3	3	5	5	29	2	—	—	7	—	—
Dec. 27	10	—	2	—	1	2	—	—	15	—	—
Dec. 30	50	22	10	4	4	2	3	6	—	471	2

stration of the remarkable individuality of the mould floras in the various dwellings.

The pollen studies gave some indication that Christmas trees may be a potential source of allergenic pollen grains. Ragweed pollen was found repeatedly in all houses after the tree was introduced, and sage and grass pollen also appeared fairly consistently (Table VIII). It should be noted that the three microscope slides were placed at the same site in the room each time, two directly under the tree and the third on a table or shelf as far from the tree as possible. The slide located at a distance from the tree showed various pollens as frequently as those situated under the tree. Apparently the pollen was airborne and did not simply fall to the floor beneath the tree. Another point of interest is the frequent occurrence of pine and spruce pollen. A tabulation of all the pollen slides for all the houses is given in Table IX. It is evident that the pollen of ragweed, sage and grasses is airborne during the time the trees are in the house as well as the pollen from the trees themselves. The weed and grass pollens appear as soon as the trees are in the house; they lessen somewhat for a few days and then reappear in even larger numbers toward the end of the two-week period as the tree continues to dry. Presumably these pollen particles became adherent to the sticky branches and needles of the conifer during the summer and fall and were released as the tree dried in the house.

Résumé

L'allergie à l'arbre de Noël: étude des moisissures et des pollens

Il arrive parfois qu'on obtienne de malades allergiques le récit de symptômes allergiques et qu'on puisse établir un lien entre cette symptomatologie et un contact avec un conifère présent à la maison ou à l'école. Nous avons étudié la fréquence et le mécanisme d'apparition de ces symptômes. Sur 1657 malades allergiques, on est parvenu à établir que des allergies respiratoires et cutanées sont survenues chez 7% d'entre eux. Ce syndrome saisonnier donne lieu à de l'éternuement, des sifflements respiratoires et de l'exanthème. Chez la majorité des sujets atteints, ces symptômes apparaissent 24 heures après le contact mais, dans 15% des cas, ils ne se manifestent qu'après plusieurs jours. L'étude des moisissures et des pollens a été faite en 10 endroits différents, avant, pendant et après l'installation de l'arbre dans la maison. Des raclures d'écorce de pin et d'épinette ont produit de grandes quantités de *penicillium*, d'*épicoccum* et d'*alternaria* mais aucune de ces moisissures n'est devenue aéroportée. Les champignons aéroportés présents dans la maison avant l'installation de l'arbre n'ont pas été notablement modifiés par la présence de ce dernier. L'étude des pollens du milieu a permis de montrer la libération dans l'air ambiant de semences et de pollens provenant de l'arbre installé dans la maison. Nous estimons que les oléorésines du sapin baumier sont probablement la cause principale des symptômes désignés sous le nom d'allergie à l'arbre de Noël.

The authors wish to express their gratitude to Mr. Walter Lewis of Hollister-Stier Laboratories Inc., Philadelphia, for his valuable assistance in carrying out pollen studies.

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